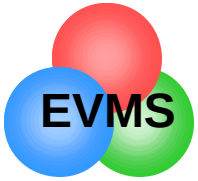
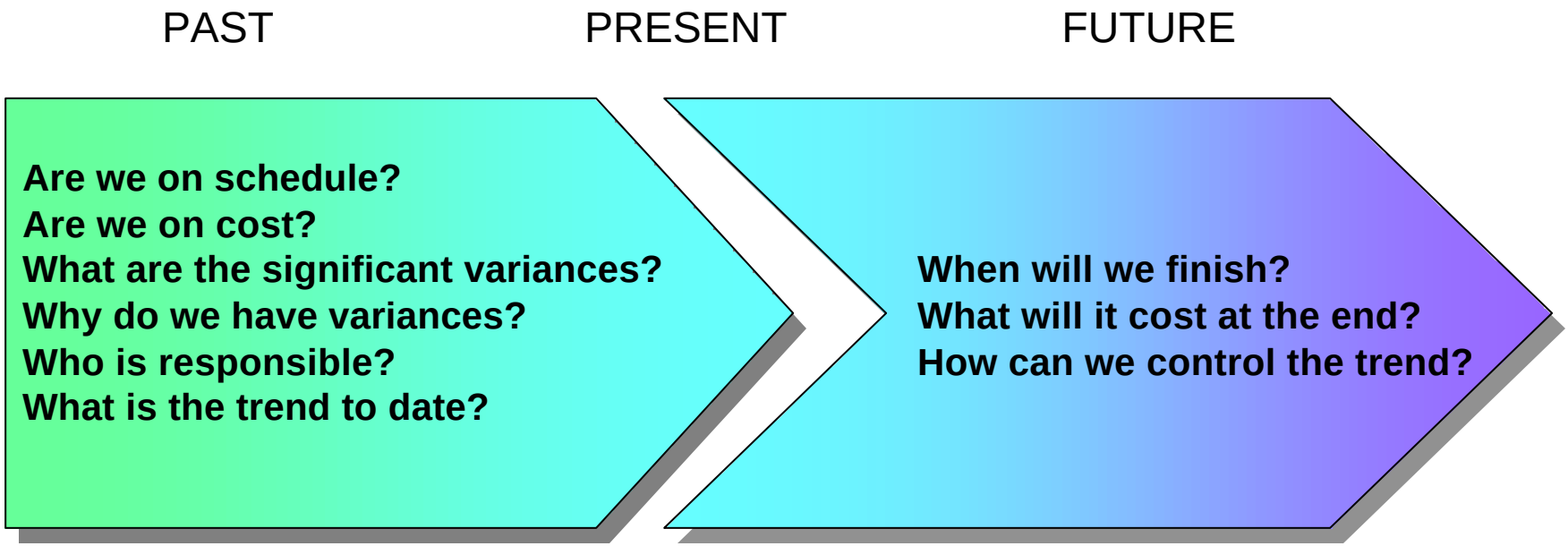


Analysis of Earned Value Data

In Depth Training for EV Analysts

Eleanor Haupt
ASC/FMCE

Questions to be Answered



We analyze the past performance……*to help us control the future*

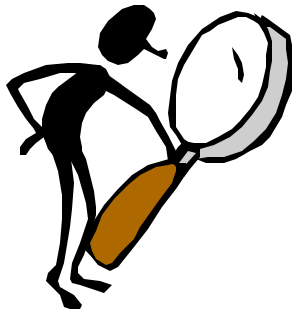
Analysis Roadmap

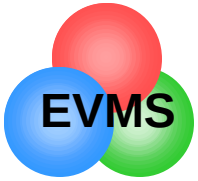
- Validity check of data
- Calculate variances
  - focus on significant variances
  - current or cumulative
- Graph and analyze trends
- Look at comparative data
- Analysis of schedule trends, critical path
- Examine written analysis by contractor
- Look at work remaining versus risk in project
- Solicit input from IPTs
- Assess realism of contractor's EAC
- Calculate independent EAC
- Formulate plan of action

what are the drivers?
what can we do about them?

Validity Check of Data

- Elements on report should total properly
  - Total BAC should equal CBB (compare to contract)
  - Format 1 totals should match Format 2 totals
  - Refer to AFMCPAM 65-501 for further checklists
- Are variances that meet the reporting threshold explained in Format 5?
- For any element:
  - Is any negative data entered for BCWS, BCWP, ACWP?
    - should be explained in Format 5
    - no negative data can be entered for BAC or LRE
  - Does ACWP exceed LRE? (should not)
  - If 100% complete, does LRE equal ACWP? (should)
  - Does BCWP or BCWS exceed BAC? (should not)
  - Is BAC or LRE equal 0? (should not)
  - Did BAC or LRE change from prior month?
    - if significant, look for explanation





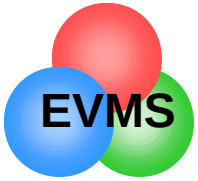
Variance Calculation

Types of Variances

- Values can be expressed as either current period or cumulative
  - current tends to be more volatile
  - use cum data to show trends
- Easy rule of thumb:

  negative value = **BAD** positive value = **GOOD**

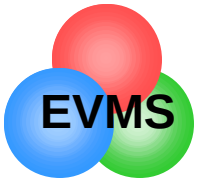
  index < 1.0 = **BAD** index > 1.0 = **GOOD**
- Absolute
  - expressed in terms of dollars or hours (e.g., -$1,000)
  - may not be able to tell significance from this amount
- Percent
  - relates absolute variance to a base (e.g., -35%)
  - shows significance
- Index
  - compares one value to another in a simple ratio
  - if you are on plan, index = 1.00



Sample Data to Analyze

Cumulative data

	BCWS	BCWP	ACWP	BAC	EAC
Computer	2,000	1,800	1,900	4,000	4,500
Radar	230	155	195	240	195
FLIR	550	750	690	1,000	1,500
Total	2,780	2,705	2,785	5,240	6,195



Schedule Variance ($)

BUDGET BASED

BCWS — of the work I scheduled to have done, how much did I budget for it to cost?

BCWP — of the work I actually performed, how much did I budget for it to cost?

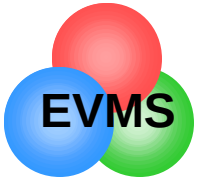
SCHEDULE VARIANCE is the difference between work scheduled and work performed (expressed in terms of budget dollars)

formula: **SV $ = BCWP - BCWS**

example: SV = BCWP - BCWS = $1,800 - $2,000

SV= -$200 (negative = behind schedule)

The computer has a schedule variance of -$200



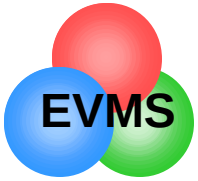
Schedule Variance (%)

Convert SCHEDULE VARIANCE to a percentage

formula: $$\text{SV \%} = \frac{\text{BCWP - BCWS}}{\text{BCWS}} = \frac{\text{SV\$}}{\text{BCWS}}$$

example: $$\text{SV \%} = \frac{-\ \$200}{\$2{,}000} = -10\%$$

The computer has a schedule variance of -$200, which equates to -10%



Cost Variance ($)

BC WP
AC WP

PERFORMANCE BASED

of the work I actually performed,
how much did I budget for it to cost?

of the work I actually performed,
how much did it actually cost?

COST VARIANCE is the difference between budgeted cost and actual cost

formula: **CV $ = BCWP - ACWP**

example: CV = BCWP - ACWP = $1,800 - $1,900
CV= -$100 (negative = cost overrun)

The computer has a cost variance of $-100

Cost Variance (%)

Convert COST VARIANCE to a percentage:

formula: $$\textbf{CV \%} = \frac{\textbf{BCWP - ACWP}}{\textbf{BCWP}} = \frac{\textbf{CV \$}}{\textbf{BCWP}}$$

example: $$\text{CV \%} = \frac{-\$100}{\$1{,}800} = -6\%$$

The computer has a cost variance of $-100, which equates to -6%

Price vs. Usage

- In elements with a significant amount of recurring material, contractor should break CV $ into price vs. usage variance
- problem: I used 10 more widgets than I planned on (58 - 68), and spent $30 more per unit than planned ($300 - $330)
- Price variance = (price difference)*(actual number of units)
  = -$30 * 68 = -$2,040
- Usage variance = (usage difference)*(original price)
  = -10 * $300 = -$3,000
- Total cost variance = -$2,040 + - $3,000 = -$5,040

may also perform similar analysis for labor (labor rate vs. hours) or for overhead (rate vs. volume)

Variance at Completion (VAC) ($)

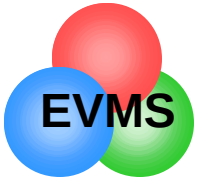
BAC — what the **total** job is supposed to cost

EAC — what the **total** job is expected to cost

VARIANCE AT COMPLETION is the difference between what the total job is supposed to cost and what the total job is now expected to cost.

FORMULA: **VAC $ = BAC - EAC**

Example: VAC $ = $4,000 - $4,500
VAC $ = - $500 (negative = projected overrun)



Variance at Completion (VAC) (%)

Convert VARIANCE AT COMPLETION to a percentage:

FORMULA: $\text{VAC \%} = \frac{\text{BAC - EAC}}{\text{BAC}} = \frac{\text{VAC}}{\text{BAC}}$

Example: $\text{VAC \%} = \frac{-\$500}{\$4{,}000} = -13\%$

The computer has a VAC of -$500, which equates to -13%

Management Reserve (MR)

- If you expect the contractor to use all MR before the end of the contract:
  - add MR to BAC when calculating % complete, % spent, % scheduled
  - add MR to BAC when calculating statistical EACs
  - if you add it, be consistent and add to all formulas

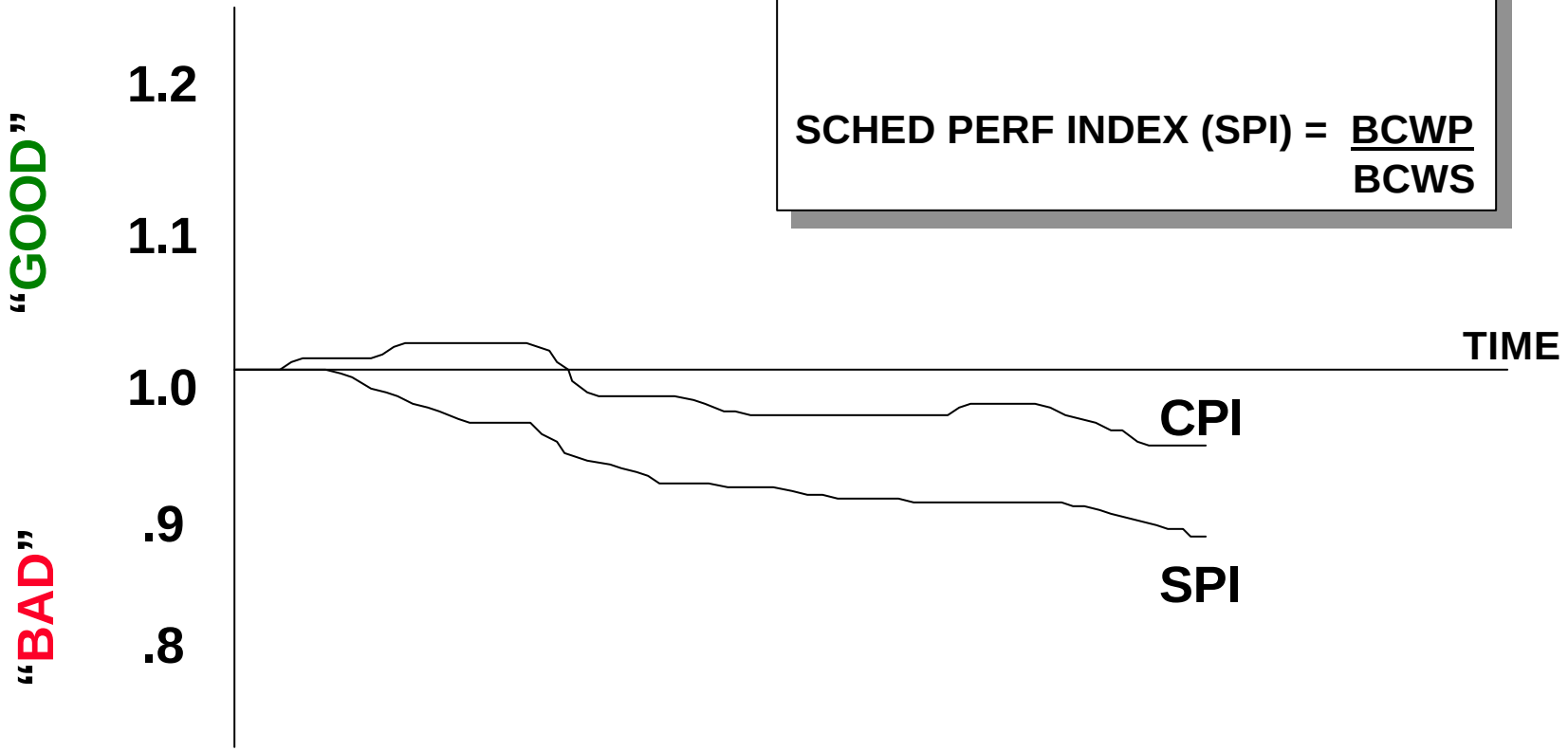
A special note about Indirects

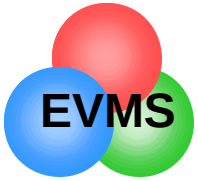
- Typically, indirect loads (overheads, Gen & Admin, COM) make up 40 - 50% of a contract's cost
- To ignore the impact of these rates would be foolhardy
- Understand the business assumptions that go into these rates
- Have contractor perform rate vs. volume analysis
  - example:
    - Manufacturing overhead total CV: -$3,200K
    - impact due to actual rate -$ 500K
    - impact due to volume (loss of commercial business) -$2,700K
- Have DCMC analyst support you with analysis of indirect variances
- Assess impact of future rate changes on outyear costs

Performance Indices

COST PERF INDEX (CPI) = BCWP / ACWP

SCHED PERF INDEX (SPI) = BCWP / BCWS





Sample Data Indices

$$CPI = \frac{\$1,800}{\$1,900} = .95$$

$$SPI = \frac{\$1,800}{\$2,000} = .90$$

Where are the significant variances?

	BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC %
Computer	2,000	1,800	1,900	(200)	-10%	0.900	(100)	-6%	0.947	4,000	4,500	(500)	-13%
Radar	230	155	195	(75)	-33%	0.674	(40)	-26%	0.795	240	195	45	19%
FLIR	550	750	690	200	36%	1.364	60	8%	1.087	1,000	1,500	(500)	-50%
Total	2,780	2,705	2,785	(75)	-3%	0.973	(80)	-3%	0.971	5,240	6,195	(955)	-18%

Worst SV ($): computer
Worst SV (%): radar

Worst CV ($): computer
Worst CV (%): radar

Worst VAC ($): computer, FLIR
Worst VAC (%): FLIR

Sorting on Variances

sorted by CV $

	WBS	DESCRIPTION	Proj Ofcr	%Comp	%Spent	CPI	CV	CV	CV %	VAC	VAC
1	3600	PCC	Zepka	28.99	34.09	0.850	↑	-296.2	-17.62	↔	-187.2
2	3200	COMMUNICATIONS	Tideman	34.63	41.03	0.844	↓	-130.8	-18.49	↔	-87.0
3	G&A	GEN & ADMIN		33.67	36.11	0.932	↓	-45.2	-7.26	↔	-36.8
4	2200	SYS ENGINEERING	Price	85.04	94.35	0.901	↓	-26.4	-10.95	↔	0.0
5	3800	I & A	Troop	35.40	37.08	0.955	↓	-24.2	-4.75	↔	-24.8
6	2100	PROJ MANAGEMENT	Brown	45.70	48.51	0.942	↔	-17.4	-6.16	↔	-3.2
7	2300	FUNC INTEGRA	Price	71.62	75.23	0.952	↓	-17.4	-5.03	↔	-30.8
8	5200	MANAGEMENT DATA	Simmons	84.18	98.10	0.858	↓	-13.2	-16.54	↑	-16.0
9	3100	SENSORS	Smith	20.87	21.49	0.971	↓	-10.6	-2.94	↔	-21.6
10	4000	SPARES	Blair	17.87	18.90	0.945	↑	-7.8	-5.78	↔	-6.2
11	6200	SYSTEM TEST	Hall	60.82	61.66	0.986	↑	-5.6	-1.38	↔	-2.0
12	5100	ENG DATA	Novak	38.51	52.80	0.729	↓	-4.6	-37.10	↔	0.0
13	MR	MGT RESERVE		0.00	0.00			0.0		↔	439.2
14	UB	UNDIST BUDGET						0.0			0.0
15	COM	COST OF MONEY						0.0			0.0
16	3700	DATA DISPLAY	Troop	41.13	41.13	1.000	↔	0.0	0.00	↔	0.0
17	OV	OVERHEAD						0.0			0.0
18	6100	TEST FACILITIES	Smart	100.00	98.02	1.020	↔	2.0	1.98	↔	0.0
19	3500	COMP PROGRAMS	Pino	46.46	44.66	1.040	↓	3.4	3.87	↔	-1.4
20	6300	PCC TEST	Bond	23.13	22.64	1.021	↓	4.2	2.10	↔	0.0
21	3400	ADPE	Zepka	41.89	39.79	1.053	↓	12.6	5.02	↔	4.6
22	3300	AUX EQUIP	Tideman	27.57	24.33	1.133	↓	78.2	11.73	↓	8.4

Analysis software tools (e.g. wInsight or Performance Analyzer) allow you to quickly sort on any column and spot the significant problems.

Guidelines

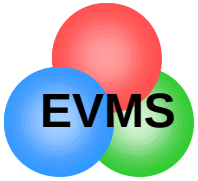
- Start by looking at significant variances ($ and/or %) in **CUM** data
  - warning: cum data may mask recent negative variances
- Don't ignore the significant, positive variances
  - what is the explanation?
    - example:

      the contractor took earnings for material (BCWP), but the actuals (ACWP) have not yet hit. This variance would reverse itself in the next cycle.
- Look at **CURRENT** period variances
  - can indicate start of trend, or significant change
    - example:

      element may still have a positive CUM variance, but the current period data shows a significant negative variance
- Variances that are very early (<5% complete) may be misleading
- How do I know if it is serious?
  - variance greater than +/-10%
  - sudden trend change
  - analysis software will flag serious variances for explanation

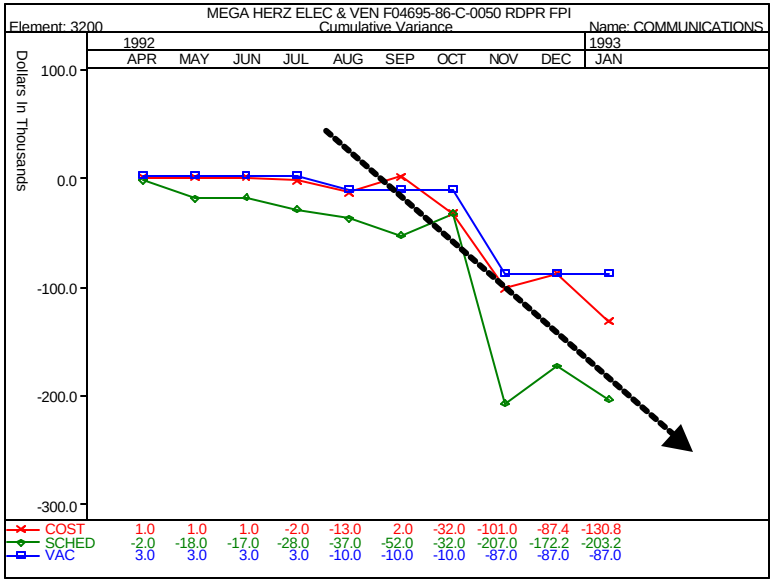
Additional screening hints

- BCWR
  - Budgeted Cost of Work Remaining (BCWR) = BAC - BCWP
    - calculated automatically by software
  - shows if there is a significant amount of work remaining or not
    - companion check: percent complete
- Use BCWR and % Complete to screen out elements that are very close to finishing, are too early to look at, or elements that are too minor
  - examples:
    - example 1: BCWR is $2K, % complete is 55% — TOO MINOR
    - example 2: BCWR is $100K, % complete is 97% — TOO CLOSE TO END
    - example 3: BCWR is $2,400K, % complete is 2% — TOO EARLY, BUT WATCH
    - example 4: BCWR is $2,000K, % complete is 38% — LOOK AT VARIANCES
- Focus your analysis efforts on significant elements



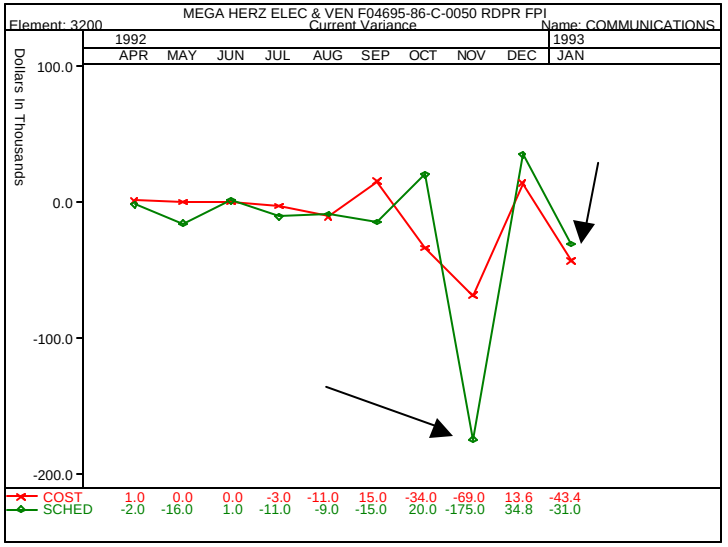
Graph and Analyze Trends

Tips for Trend Analysis

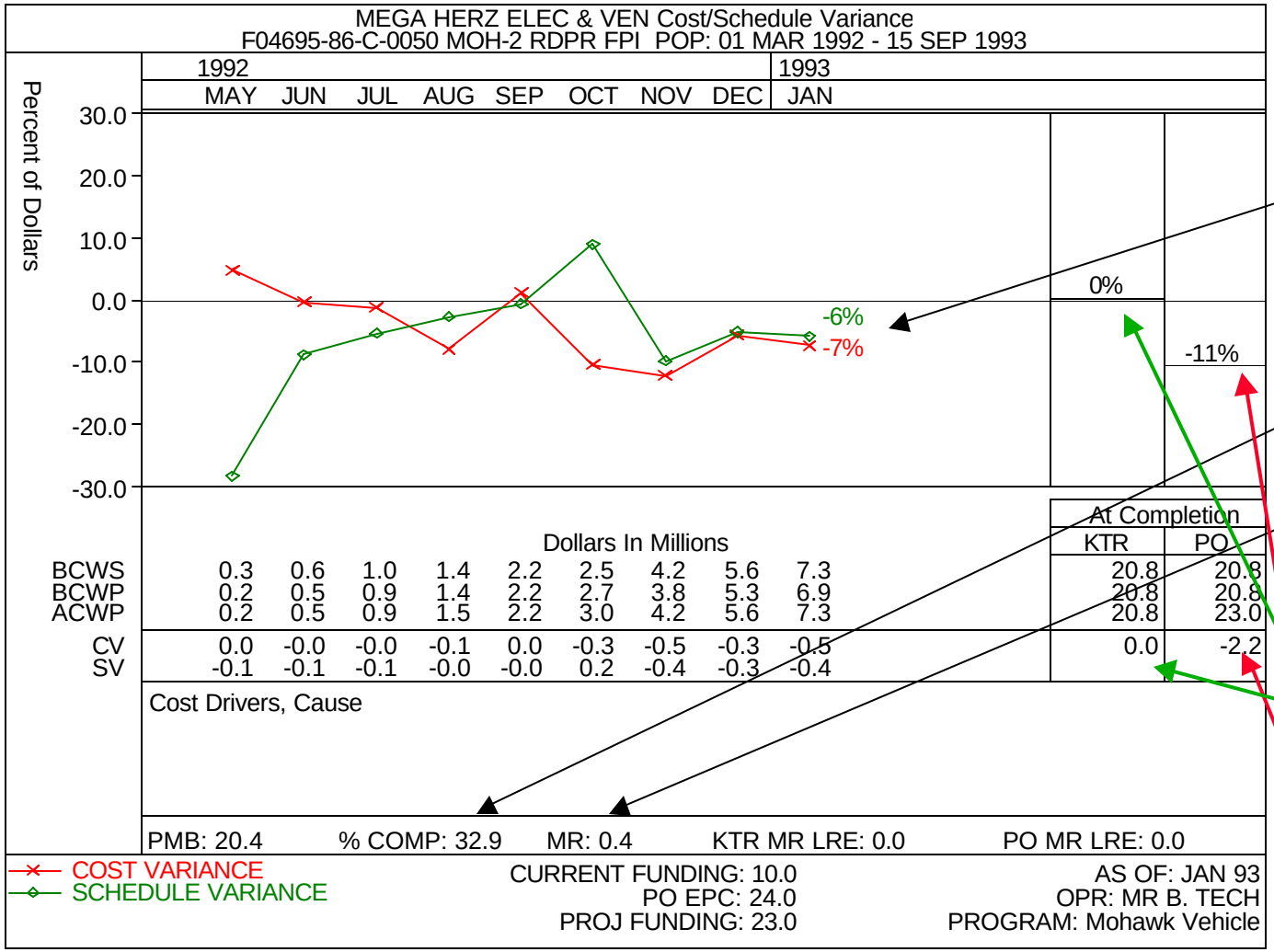


Cum charts show overall trend... are you getting better, or worse?

Current charts show the months where there were significant performance problems.



Total Program Variances



Analysis:

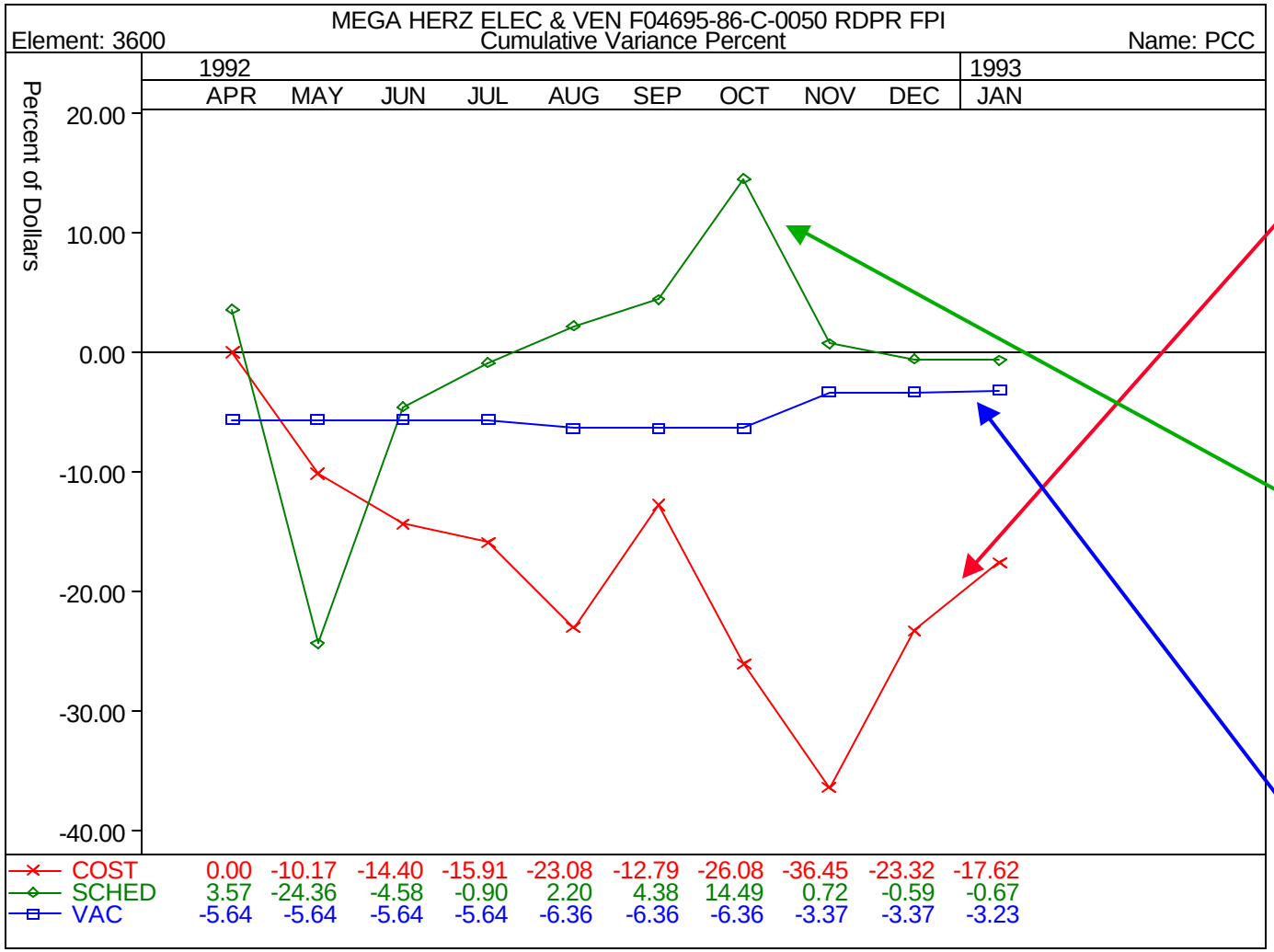
Both cost and schedule trends have been negative for several months, and declined this month.

Contractor is 33% complete.

Management Reserve is .4M (2% of PMB).

Contractor expects to finish on budget (0% VAC). Program Office expects -2.2 VAC, or -11%, and expects cost performance to decline.

Trend Chart for Elements



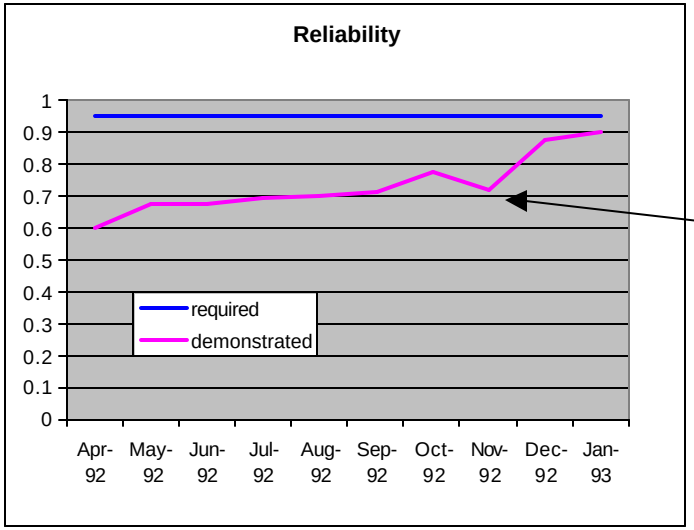
Analysis:

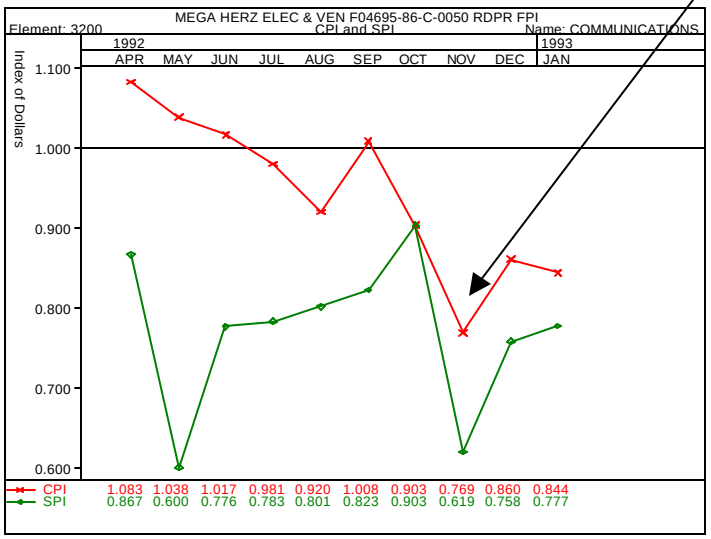
Cost: this element experienced significant cost problems in Aug, Oct, Nov. Shows some recovery, but still a serious cost variance. Reason why:

Schedule: this element showed early schedule problems, but recovered and was significantly ahead of schedule in Oct. Recent performance has declined and now slightly behind schedule. Why:

VAC: Contractor revised (decreased) LRE in Nov and claims only -3% at complete. DOESN'T MATCH COST PERFORMANCE.

Show performance against technical performance



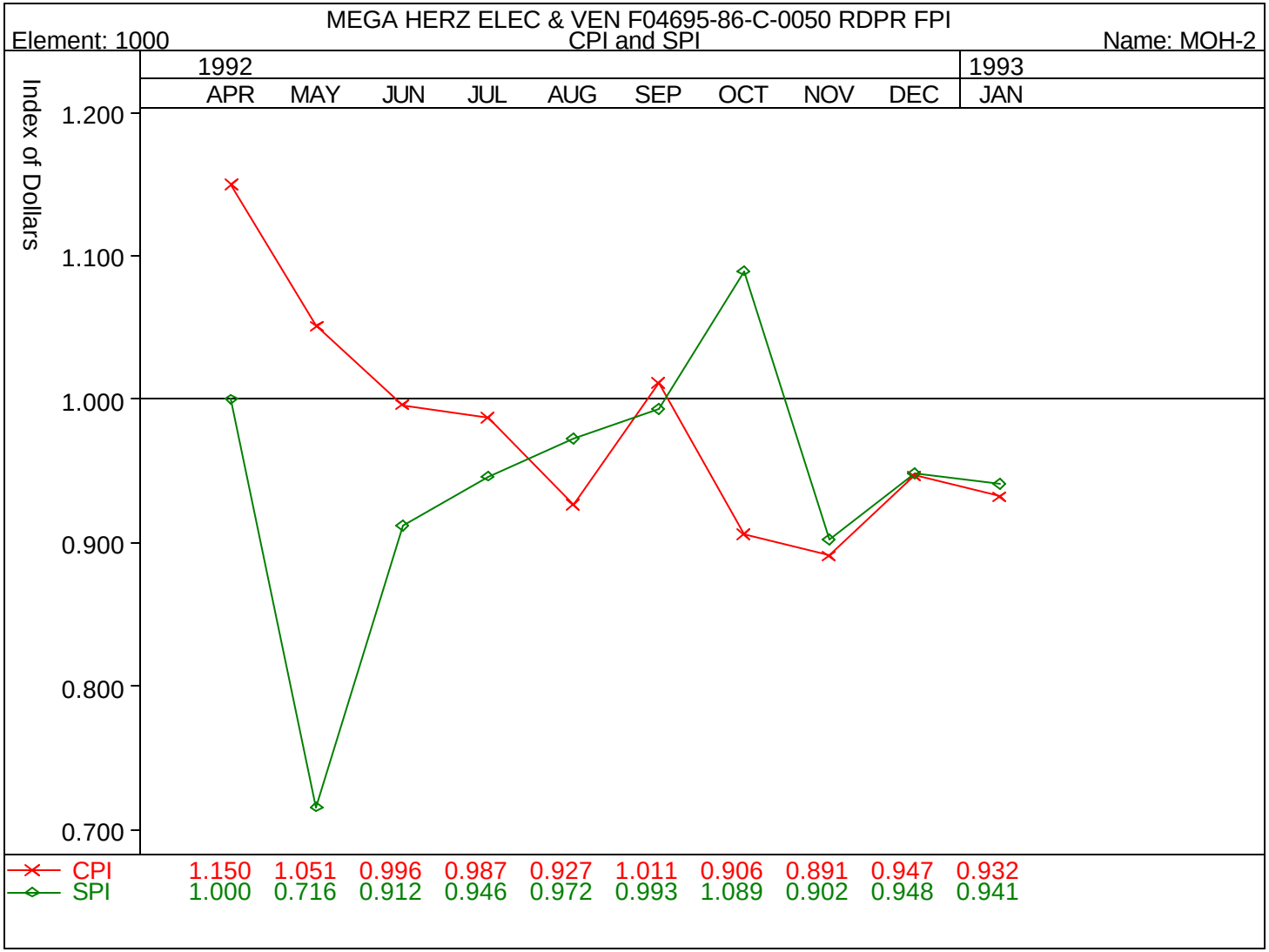


Is there a correlation between technical performance and earned value performance?

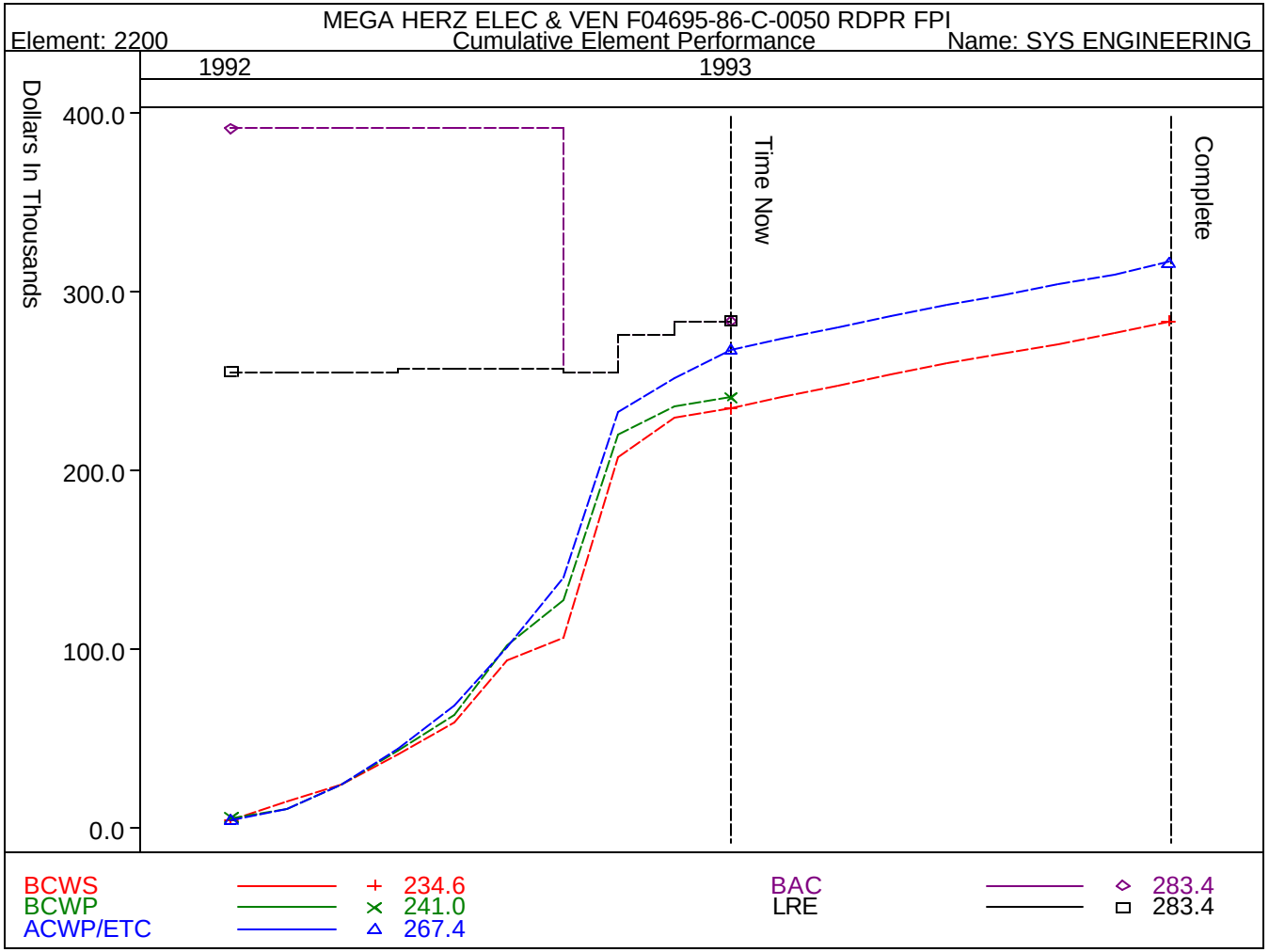
Can poor technical performance be used to predict schedule and cost problems?

Use appropriate trend data. What is technical driver that would drive performance data?

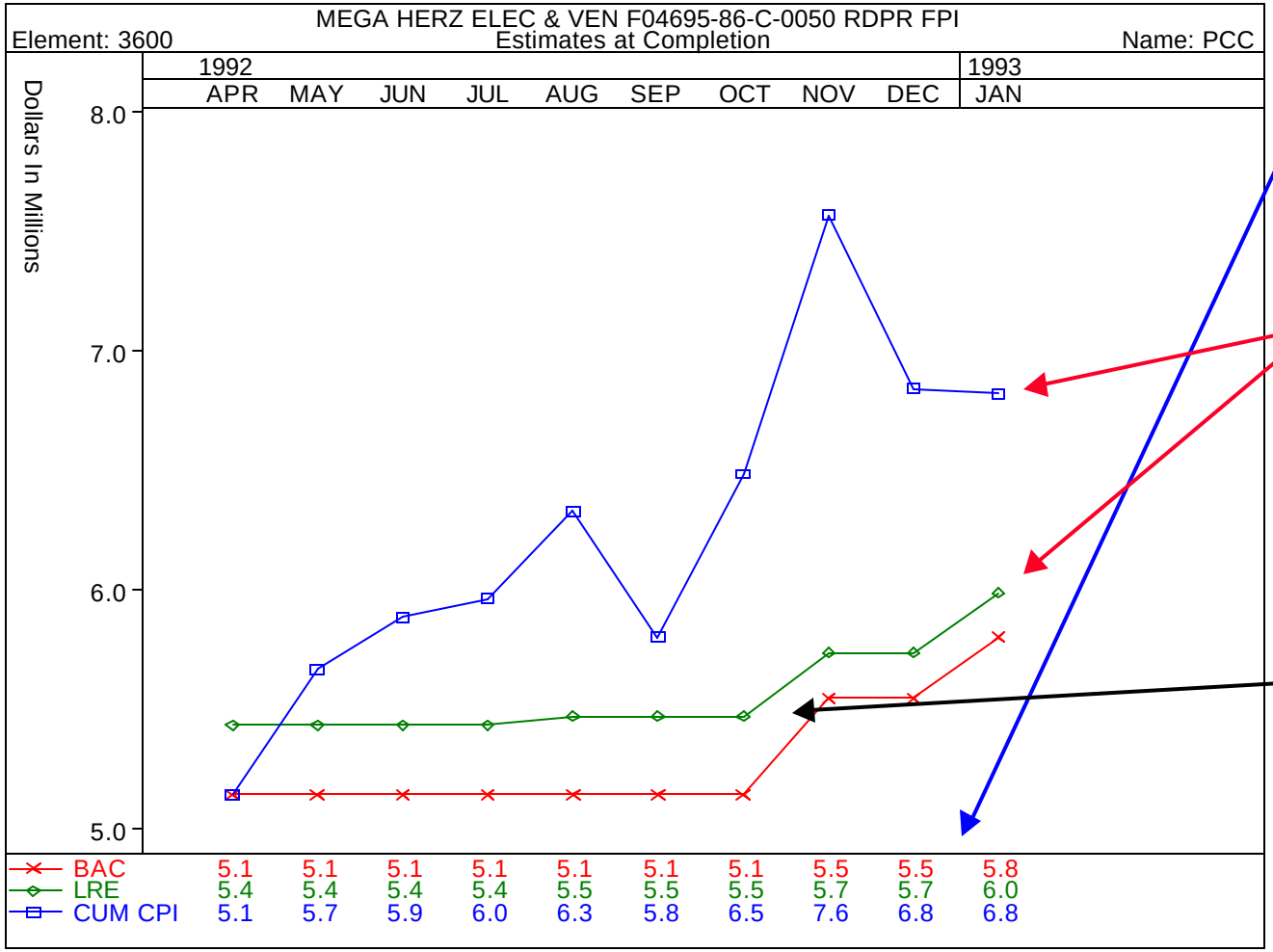
CPI and SPI


MEGA HERZ ELEC & VEN F04695-86-C-0050 RDPR FPI
Element: 1000
CPI and SPI
Name: MOH-2
1992
1993
APR MAY JUN JUL AUG SEP OCT NOV DEC JAN
Index of Dollars
1.200
1.100
1.000
0.900
0.800
0.700
CPI 1.150 1.051 0.996 0.987 0.927 1.011 0.906 0.891 0.947 0.932
SPI 1.000 0.716 0.912 0.946 0.972 0.993 1.089 0.902 0.948 0.941

Snake chart


MEGA HERZ ELEC & VEN F04695-86-C-0050 RDPR FPI
Element: 2200
Cumulative Element Performance
Name: SYS ENGINEERING
1992
1993
Dollars In Thousands
400.0
300.0
200.0
100.0
0.0
Time Now
Complete
BCWS
BCWP
ACWP/ETC
234.6
241.0
267.4
BAC
LRE
283.4
283.4

EAC Realism



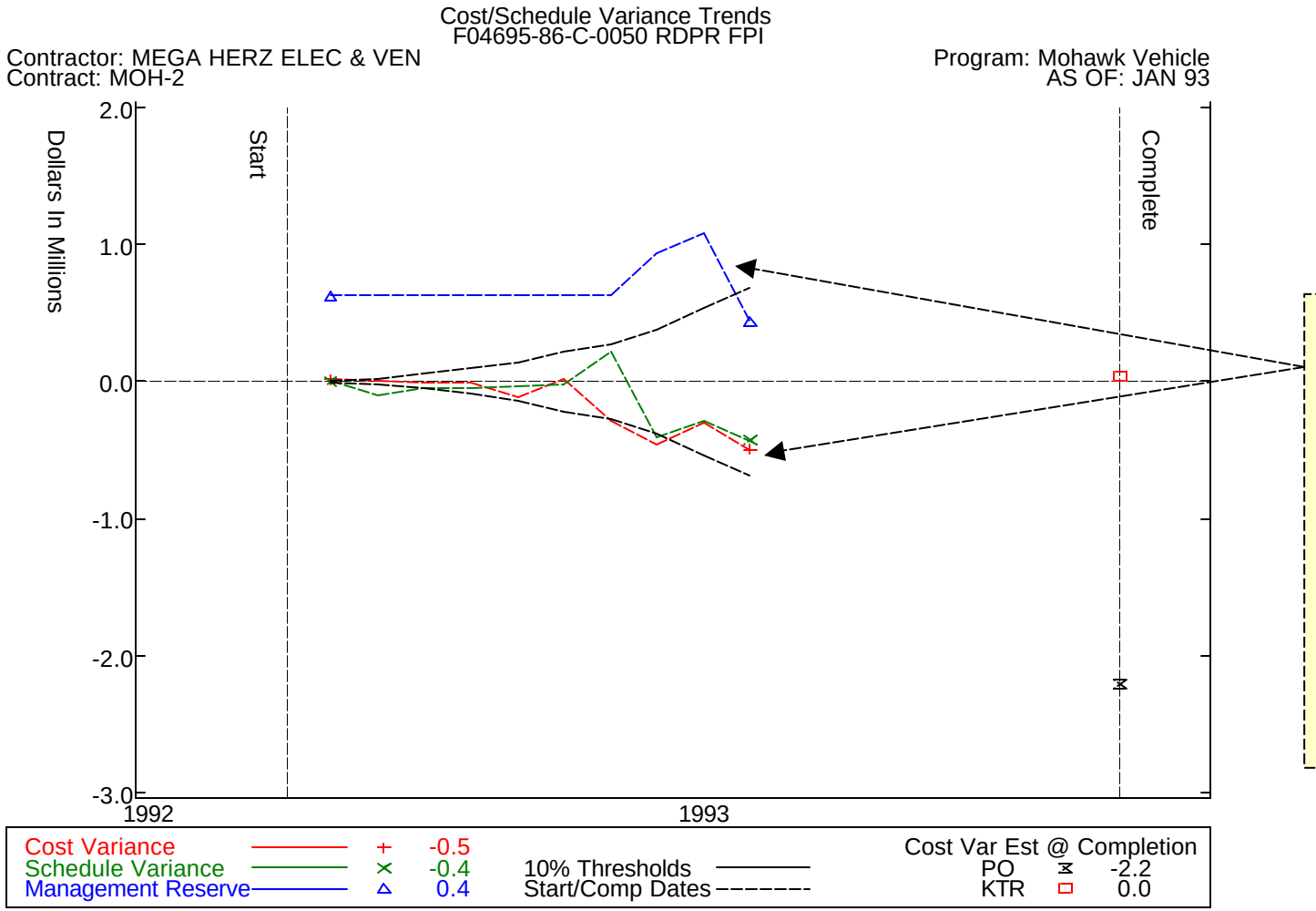
Shows changes in BAC and LRE.

Compares budget vs. contractor's LRE.

Software calculates EAC based on cum CPI. Compare this to the LRE.

Analysis: contractor increased the budget for this element twice. Contractor also increased the LRE twice, but NOT AS MUCH as the BAC. Based on past performance as reflected in the Cum CPI forecast for EAC, the contractor's LRE is UNREALISTIC.

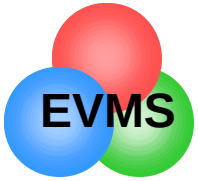
Keep an eye on Management Reserve



Compare MR changes to cost variances.

***CAUTION*: MR should not be applied to offset cost variances.**

Both MR and UB should be explained in Format 5.



Comparative Data

Schedule Status

compare

% scheduled = BCWS / BAC x 100% = 2,000 / 4,000 = 50%

% completed = BCWP / BAC x 100% = 1,800 / 4,000 = 45%

I should have completed 50% of the total work.

I only completed 45% of the total work.

Budget Status

budget status

% spent (original budget) = $\frac{\text{ACWP}}{\text{BAC}}$ x 100%

compare:

% spent vs. % complete

example: 48% spent vs. 45% complete

Compare CV to VAC

Example 1:	CV	-6%
	VAC	-13%

I project that performance will get worse and result in a bigger overrun

Example 2:	CV	-15%
	VAC	-8%

I project that performance will get better. I'll have better cost efficiencies in the future than I do now.

Example 3:	CV	-12%
	VAC	-12%

I project that performance will stay the same

Compare color coding

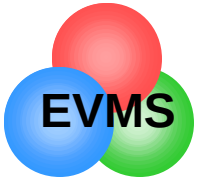
	DESCRIPTION	LVL	LL	SV	CV	VAC
1	PCC	3	√	↓	↑	↔
2	COMMUNICATIONS	3	√	↑	↓	↔
3	GEN & ADMIN	2	√	↓	↓	↔
4	SYS ENGINEERING	3	√	↔	↓	↔
5	I & A	3	√	↓	↓	↔
6	PROJ MANAGEMENT	3	√	↑	↔	↔
7	FUNC INTEGRA	3	√	↓	↓	↔
8	MANAGEMENT DATA	3	√	↑	↓	↑
9	SENSORS	3	√	↑	↓	↔
10	SPARES	2	√	↑	↑	↔
11	SYSTEM TEST	3	√	↓	↑	↔
12	ENG DATA	3	√	↓	↓	↔
13	MGT RESERVE	2	√			↔
14	UNDIST BUDGET	2	√			
15	COST OF MONEY	2	√			
16	DATA DISPLAY	3	√	↑	↔	↔
17	OVERHEAD	2	√			
18	TEST FACILITIES	3	√	↔	↔	↔
19	COMP PROGRAMS	3	√	↔	↓	↔
20	PCC TEST	3	√	↑	↓	↔
21	ADPE	3	√	↓	↓	↔
22	AUX EQUIP	3	√	↓	↓	↓

Compare color coding for CV versus VAC.

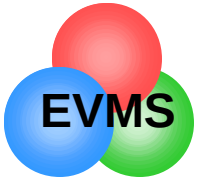
Flag all elements for further analysis that rate CV a different color than VAC, but especially those with a red CV and green VAC.

Elements with a red SV coding and green CV coding may indicate an emerging problem.

note: software allows you to establish color thresholds.



Analysis of Schedule

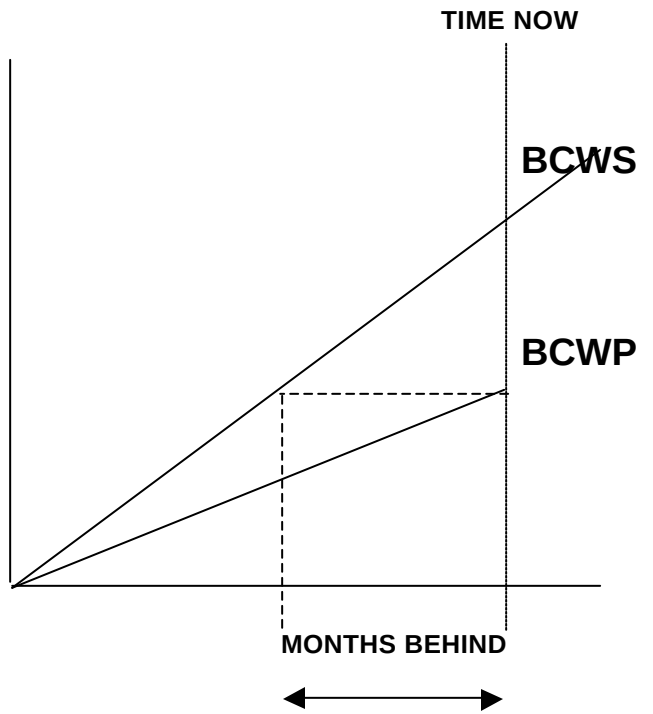


Schedule Analysis

- Early warning: schedule variances are usually an early warning of cost variances to follow
- Schedule variances in EVMS should be seen as indicators and warnings
- True schedule analysis should be performed on the integrated master schedule
  - Analysis of critical path activity
  - Work with program office schedule analyst
  - Performance data and formal schedule should indicate same problems and risk areas
- Some software allows you to synch the master schedule and performance data for an integrated assessment

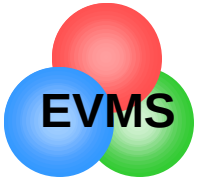
Converting SV $ to Months

Either technique can be used to convert SV from dollars to approximate months. Note that this is dependent on average of work scheduled and is only an approximation.



Draw a parallel line from BCWP back to intersect BCWS, then drop down to read off the X axis (time).

$$\text{Months ahead or behind} = \frac{\text{SV \$}}{\text{Average monthly BCWS \$}}$$



Examine written analysis

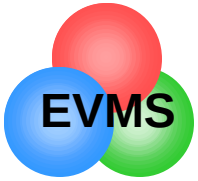
Variance Explanations

- **Format 5 variance analysis should address:**
  - separate discussion of CV, SV (current and cum) and VAC
  - clear description of reason for variance
  - quantity variances (e.g., price vs. usage)
  - be specific, not general
  - corrective action
  - technical, schedule, and cost impacts
  - impact to estimate at completion

  - should be written by CAM!

Significant Variances

- What is a **significant** variance?
  - % variance (e.g., >10%)
  - $ variance (e.g., >$50,000)
  - critical path element
  - risk/complexity
  - impact to other elements
  - Top 10, Top 20, etc.
  - contractor defined



Work Remaining vs. Risk

Need to look ahead

Format 5 Narrative Report

Element Code: 25 Project Officer: BUETTGENBACH
Element Name: AVIONICS IPT Office Symbol: 25

Schedule Variance:
Month: $0K
Avionics is essentially on schedule.

Cumulative: ($54K)
Cumulative negative variance is due to the following. ……

GCAM, Robert Gemin, 6 Oct. 97

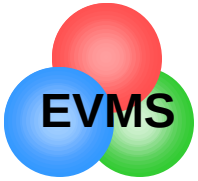
I consider this month's assessment accurate and complete. Looking forward one could expect additional variances for the following reasons:

SV may increase temporary due to late delivery of... … SV will still appear for the upcoming months.

CV will increase in the upcoming month for two reasons. … ..

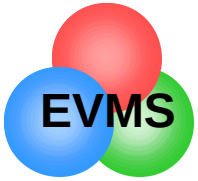
excerpts from actual analysis….

Contractor was incurring relatively small variances, but the government manager saw risks ahead

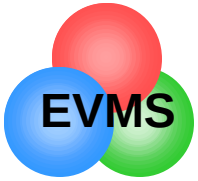


Look Ahead

- Government control account managers (GCAMs) should keep up to date on what the PMB looks like for their element
  - "IBR" should be seen as continuous process
  - Continue the dialogue with contractor counterparts
    - Sample:
      - **"I know that we failed the reliability test this month. What impact will this have on the remaining schedule and budget?"**
    - Don't wait until the formal report is received
- GCAMs are the technical managers, and understand the nature of the technical risks ahead
  - Are developing problems in the performance report analyzed and included in the formal risk plan?
  - Are items in the formal risk plan analyzed for cost and schedule impacts?
  - Are highly probable risk elements included in the EAC?
  - Is the system engineer evaluating the integration of all elements?
- Program office may wish to perform a formal Integrated Risk Assessment on the program



Soliciting input from the IPTs



Analysis within the Program Office

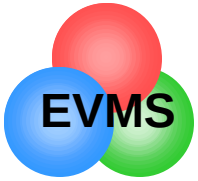
- Assign to technical managers within program offices
  - Government Control Account managers (GCAMs)
- Conduct monthly team variance meetings
- Open, honest communication essential
  - Oral, e-mail, and face-to-face discussions
  - Continuing dialogue dramatically improves Format 5
- Early warning analysis
  - Top level cost and schedule analysis by EVMS and schedule analysts
    - analysts should actively seek input from IPTs
  - CAM/GCAM analysis at lowest level
    - analysis should be loaded into network for availability to entire team
- Work closely with DCMC team
- Share results of analysis with contractor

Program Manager Ownership

- **Program managers/IPT leads should be able to access complete data base from their desk**
  - typical question: “What is this trend telling me?”
  - PMs go directly to CAMs/GCAMs for details
  - program managers should focus on significant trends
  - program managers should receive EVMS training
- **Program managers chair variance analysis meetings**
  - not a financial function
  - should lead dialogue with contractor
- **EVMS metrics should be fully integrated into program reviews**
  - internal to company
  - to government program office

experience shows….

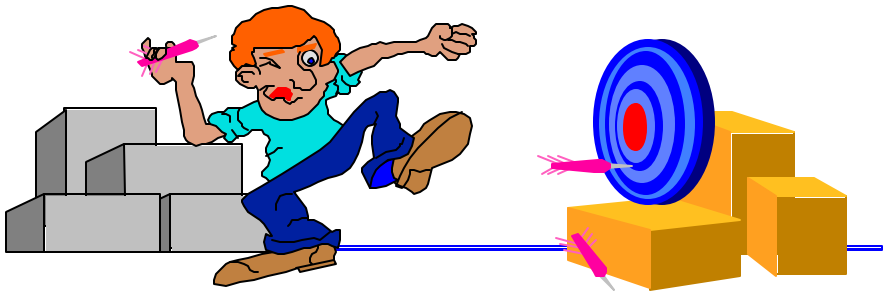
if a program manager shows that he uses EVMS to manage, then the IPTs will follow. It is very difficult for the IPTs to maintain interest on a long term basis without this leadership.



Assessing EAC Realism

What will be the final cost?

- **Estimate at Completion (EAC)**
  - defined as actual cost to date + estimated cost of work remaining
  - contractor develops comprehensive EAC at least annually
    - reported by WBS in cost performance report
  - should examine on monthly basis
  - consider the following in EAC generation
    - performance to date
    - impact of approved corrective action plans
    - known/anticipated downstream problems
    - best estimate of the cost to complete remaining work
  - also called latest revised estimate (LRE), indicated final cost, etc.

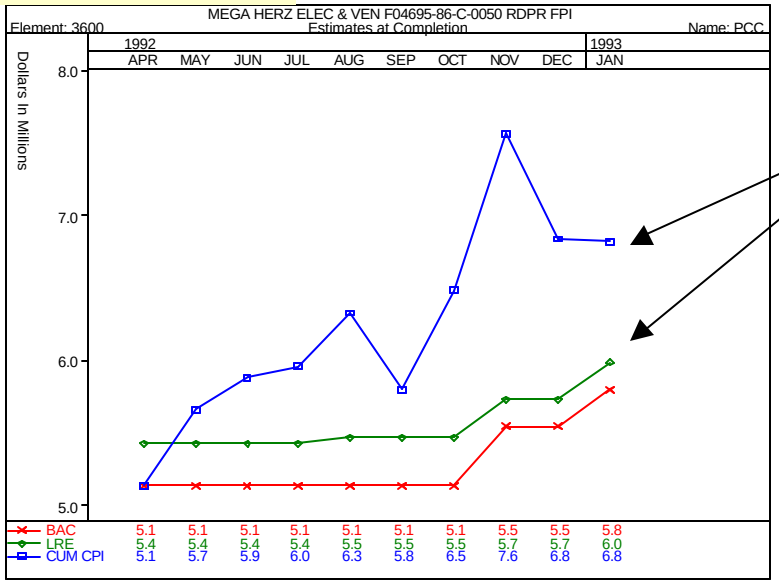


ACWP + ETC = EAC

How can I assess EAC realism?

- **Method 1: look at trend chart**
  - compare BAC vs. LRE vs. Cum CPI forecast
  - portrays size of gap between contractor's projected performance and past performance

Standard EAC chart



How can I assess EAC Realism?

- **Method 2: compare following data**

CPI_{cum} (past cost efficiency) = $\frac{BCWP}{ACWP}$

TCPI-LRE (projected efficiency needed to come in at LRE) = $\frac{\text{Work Remaining}}{\text{Estimate Remaining}}$ = $\frac{BAC - BCWP}{LRE - ACWP}$

EAC Realism View

	DESCRIPTION	% Compl	CV	VAC	VAC	BAC	LRE	EAC (CPI)	CPI	TCPI-LRE	CPI to LRE
1	SYS ENGINEERING	85.04	↓	↔	0.0	283.4	283.4	314.4	0.901	2.650	-1.749
2	ENG DATA	38.51	↓	↔	0.0	32.2	32.2	44.1	0.729	1.303	-0.573
3	DATA	72.60	↓	↔	-16.0	127.0	143.0	151.5	0.838	1.055	-0.216
4	COMMUNICATIONS	34.63	↓	↔	-87.0	2,043.0	2,130.0	2,420.8	0.844	1.034	-0.190
5	PCC	28.99	↑	↔	-187.2	5,800.6	5,987.8	6,822.4	0.850	1.027	-0.177
6	PROJ MANAGEMENT	62.79	↓	↔	-34.0	1,384.6	1,418.6	1,482.1	0.934	1.056	-0.122

rule of thumb

should be within 5% of each other (.05)

How can I assess EAC Realism?

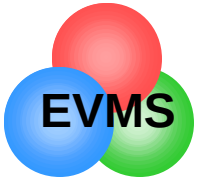
- **Method 3: Compare various statistical forecasts**

From 6 period summary report

PAST SIX MONTHS

Statistical and Independent Forecasts						
3 PER AVG	6467.8	5777.2	6719.3	7971.4	7171.6	6603.8
6 PER AVG	6329.8	5800.6	6539.2	7663.2	6883.9	6833.0
CUM CPI	6329.8	5800.6	6484.3	7568.9	6840.9	6822.4
CUR CPI	7053.4	5024.3	9009.5	9271.7	5687.4	6156.9
COST & SCH	5652.6	5376.4	5455.8	6554.9	6302.1	6446.5
LINEAR REG 6	383.8	5934.1	6314.3	7339.1	7056.1	7039.5
PERF FACTOR	5699.8	5671.9	5761.5	6322.3	6267.5	6508.7
USER EAC	0.0	0.0	5455.8	0.0	0.0	6822.4
CPI*SPI	6202.1	5581.9	5767.1	7522.7	6872.5	6855.3
MICOM EAC	5470.0	5470.0	5815.1	7616.3	6915.7	6866.0

- **for the current month, EACs range from 6,157K to 7,040K**
- **Contractor's EAC was 5,988K**



Calculate an Independent EAC

Survey says…..

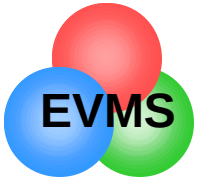
- over 800 military programs show that .....

no program has ever improved performance better than the following EAC calculation

$$EAC = \frac{BAC}{CPI}$$

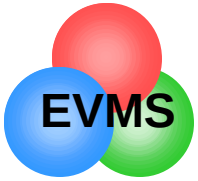
at 15% complete point in program

no one pays enough attention in the **early stages!**



Why do we need accurate EACs?

- **Variance at Completion vs. Contractor Loss**
  - **Positive VAC:**
    - EAC < BAC underrun contractor gain
  - **Negative VAC**:
    - EAC > BAC share area contractor partial loss
    - EAC > ceiling overrun contractor loss (100%)
- **Government develops top level EAC for comparison**
  - government will limit progress payments if EAC is greater than ceiling
  - government needs forecast of fund requirements
- **May still have time to change the final outcome**



One method: statistical formulae

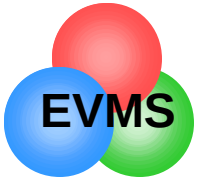
- **Common EAC Formulae:**

$$EAC = \frac{BAC}{CPI}$$

$$= ACWP_{cum} + \frac{\text{Budgeted Cost of Work Remaining}}{CPI_3}$$

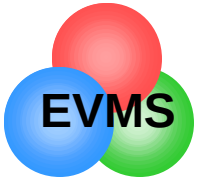
$$= ACWP_{cum} + \frac{\text{Budgeted Cost of Work Remaining}}{.8(CPI) + .2(SPI)}$$

$$= ACWP_{cum} + \frac{\text{Budgeted Cost of Work Remaining}}{CPI * SPI}$$



Other methods of EAC calculation

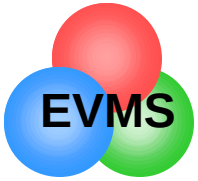
- “Grass Roots” or formal EAC
  - detailed build-up from the lowest level detail
  - hours, rates, bill of material, etc.
- Average of statistical formulae
- Show range of EACs (optimistic, most probable, pessimistic)
- Complete schedule risk analysis for remaining work, estimate work remaining



Formulate a Plan of Action

What to do next...

- Have a process for integrated analysis within program office
  - Include DCMC team
  - What does the program manager need to see on a regular basis?
    - what format? (briefing, memo, or on-line)
  - Provide regular training, workshops, etc.
- Make sure that the analysis gets into the right hands
  - Use flash data to alert the program manager ASAP
    - try to get Format 1 or 2 data as soon as possible
  - Program management team should be using it to control program
  - EVMS analysis should be integrated into program management type reviews
  - Provide a feedback copy to the contractor and to DCMC



Mutual Goal: Effective Variance Analysis

- Make it meaningful
  - avoid routine explanations
- Make it timely
  - flash data allows for real time discussions
- Make it streamlined
  - significant variances
- Make it right
  - work with contractor to get the information we need
- Get the information to the right players

make this a mutual goal with your contractor

Forward Look - Focus on the Right Things

Time now

Where we've been

CPI

Cum SV$

Cum CV$

Variance explanation

SPI

3 month avg

COST HISTORY

Where we're going

Schedule risk

BCWR

Technical risk

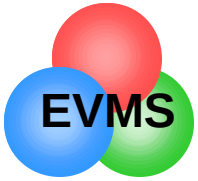
TCPI-LRE

ETC

TCPI-BAC

Projected variances

COST AVOIDANCE



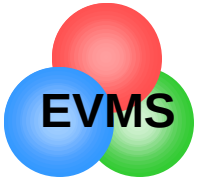
USE DATA FOR DECISION MAKING

- **Behind Schedule**

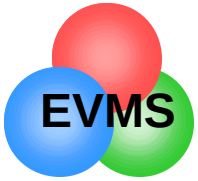
  - How critical is schedule?
  - Can I afford to work overtime to recover?
  - Can I do tasks concurrently?
  - Are there technical innovations which could speed up the process?
  - Am I “gold plating” instead of just meeting requirements?
  - Should I do a schedule risk assessment to project impact to program?

- **Over Cost**

  - Can I reschedule tasks? (Timephasing)
  - Is there a less costly facility I can use?
  - Are there tasks which can be deleted?
  - Should the element be added to my risk management profile?



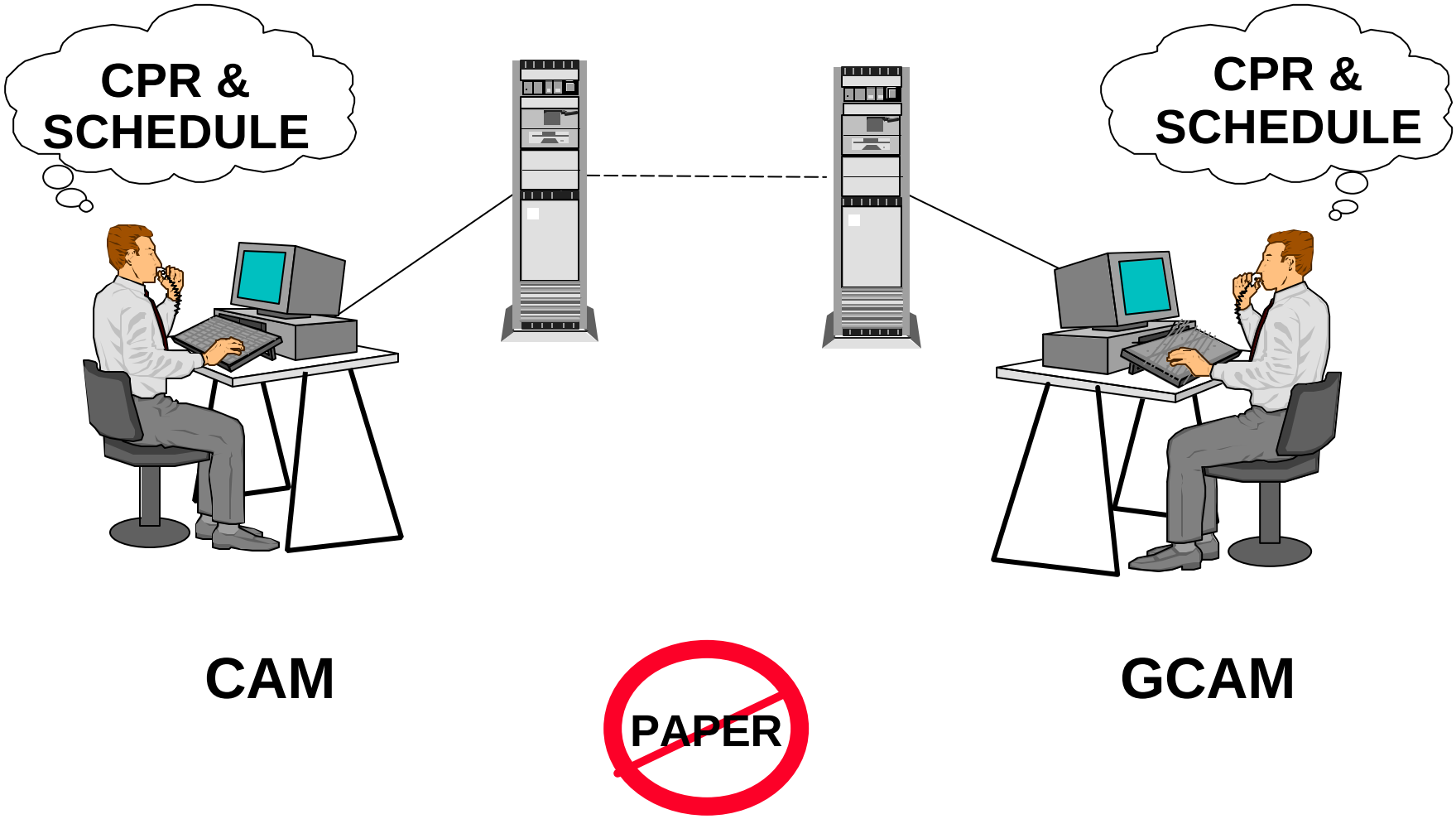
Special Topics



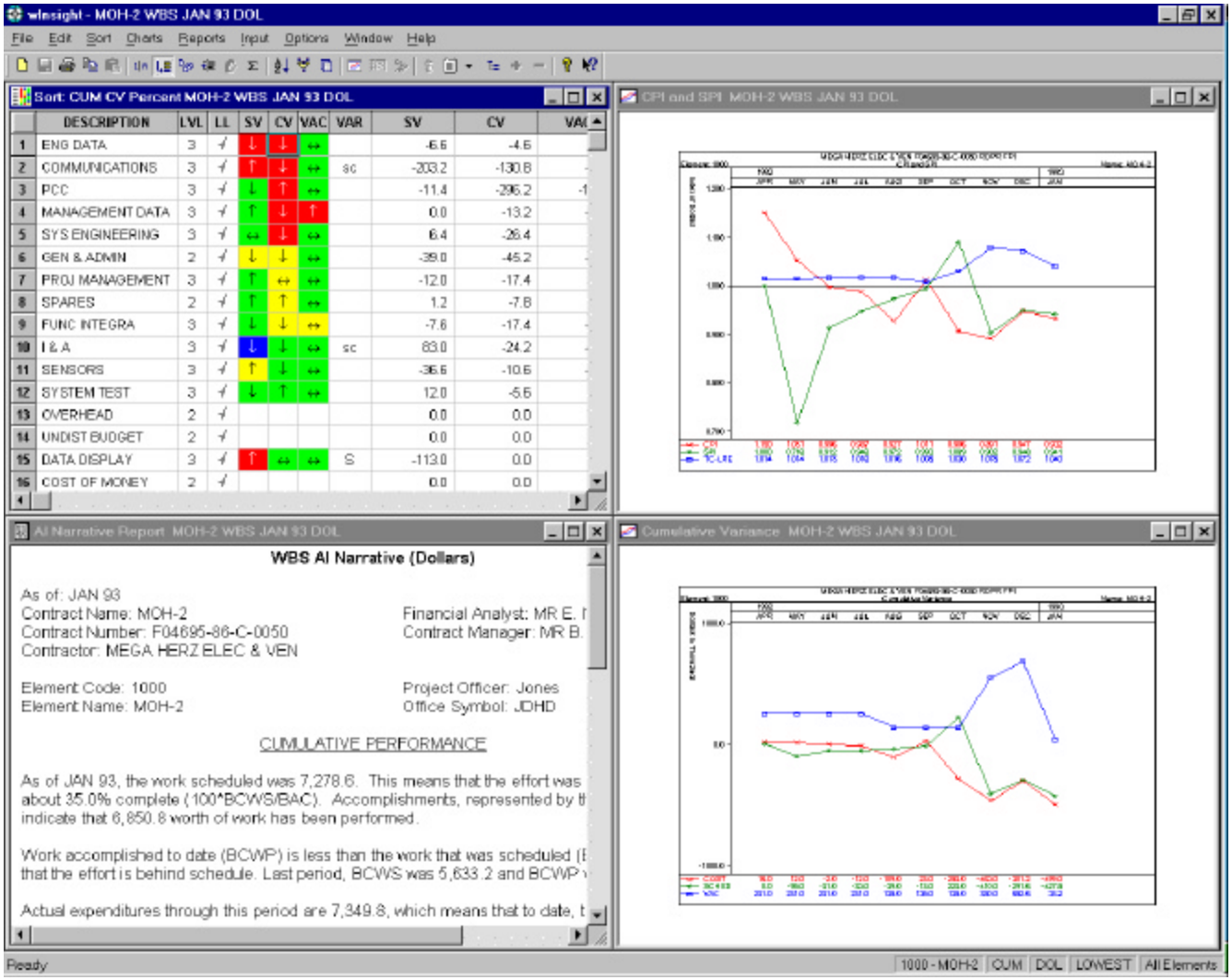
Setting up an Early Warning System

- Flash data received ASAP, no written analysis
- EVMS and schedule managers review data
- Teleconference with DCMC
  - evaluate cost and schedule variances
  - evaluate trends
  - evaluate against program master schedule
- Prepare top level analysis to program manager and IPT leads
  - recommend elements for further analysis
- GCAMs discuss their elements with CAMs
  - write up own variance analysis
- Don’t wait until you get the report to communicate!

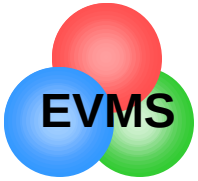
New Advances in Software Analysis Tools



Let software tools do the number crunching



	DESCRIPTION	LVL	LL	SV	CV	VAC	VAR	SV	CV	VA
1	ENG DATA	3	√	↓	↓	↔		-6.6	-4.6	
2	COMMUNICATIONS	3	√	↑	↓	↔	sc	-203.2	-130.8	
3	PCC	3	√	↓	↑	↔		-11.4	-296.2	-1
4	MANAGEMENT DATA	3	√	↑	↓	↑		0.0	-13.2	
5	SYS ENGINEERING	3	√	↔	↓	↔		6.4	-26.4	
6	GEN & ADMIN	2	√	↓	↓	↔		-39.0	-45.2	
7	PROJ MANAGEMENT	3	√	↑	↔	↔		-12.0	-17.4	
8	SPARES	2	√	↑	↑	↔		1.2	-7.8	
9	FUNC INTEGRA	3	√	↓	↓	↔		-7.6	-17.4	
10	I & A	3	√	↓	↓	↔	sc	83.0	-24.2	
11	SENSORS	3	√	↑	↓	↔		-36.6	-10.6	
12	SYSTEM TEST	3	√	↓	↑	↔		12.0	-5.6	
13	OVERHEAD	2	√					0.0	0.0	
14	UNDIST BUDGET	2	√					0.0	0.0	
15	DATA DISPLAY	3	√	↑	↔	↔	S	-113.0	0.0	
16	COST OF MONEY	2	√					0.0	0.0	



Joint Use of Software Tools

- **Trend Analysis - Where Have we Been?**
  - Lowest WBS level or IPT level
  - color codes, charts
- **Projection of future - How Bad Can it Get?**
  - EAC trends
  - comparison of cost efficiencies
- **Focus on problems - What are the significant drivers?**
  - Sort by elements, trends, CAM names
  - autosync to program schedule
- **Format 5 Analysis - What are we doing about it?**
  - Joint analysis, corrective plans, risk mitigation
- **Report generator**
  - all formats
  - can go **paperless**